FORT LAUDERDALE-HOLLYWOOD INTERNATIONAL AIRPORT
Draft Environmental Impact Statement

NOTE: This DRAFT document details the methodology and procedure used to prepare the hazardous air pollutant (HAP) evaluation for the Fort Lauderdale-Hollywood International Airport (FLL) Draft Environmental Impact Statement (DEIS). It is provided for deliberative purposes only and should not be cited or quoted. This DRAFT document was developed through coordination with the Federal Aviation Administration (FAA), the Broward County Aviation Department (BCAD), the U.S. Environmental Protection Agency (USEPA) Region 4, and the USEPA Office of Transportation and Air Quality, Ann Arbor, Michigan. The data in the document are based on the best available information and are consistent with USEPA-approved methodologies for HAP evaluations. If major components of the DEIS project are changed, this report will be revised by FAA as necessary.

DRAFT

Appendix G.1.B

Hazardous Air Pollutant (HAP) Evaluation

March 2007

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G.1.B.1.0 INTRODUCTION

The Federal Aviation Administration (FAA) determined that an evaluation of airport-related hazardous air pollutant (HAP) emissions should be included in the Draft Environmental Impact Statement (DEIS) prepared for the Fort Lauderdale-Hollywood International Airport (FLL). The Airport Sponsor's Proposed Project would be to widen and lengthen Runway 9R/27L, in a manner equivalent to operational characteristics of existing parallel Runway 9L/27R.

An evaluation of HAP emissions due to airport projects is not required under the National Environmental Policy Act (NEPA) or by the provisions of the Clean Air Act (CAA), including the 1990 Amendments. However, during scoping conducted at the initiation of the environmental review process, public comments with respect to the airport project and hazardous pollutant emissions convinced the FAA that an evaluation of HAP emissions should be included in the assessment of air quality impacts.

The HAP evaluation includes a project-level emission inventory of selected HAPs based on the criteria and precursor pollutant emission inventory prepared to satisfy other regulatory requirements for the air quality assessment. The HAP inventory is provided for disclosure purposes only and should not be relied on as an interpretation of health risks, should not be compared to other sources of HAPs in the region, or compared to HAP emissions reported for other airports.

G.1.B.1.1 Limitations of the HAP Evaluation

The HAP evaluation was prepared using the best available information, accepted USEPA methodology, and procedures as determined appropriate through coordination with the relevant Federal, state, and local air agencies. The calculation of annual HAP emissions was based on fractional values applied to the total project emissions of hydrocarbons (HC), volatile organic compounds (VOC), particulate matter (PM_{10}), or fuel throughput that can be credibly defined and identified as hazardous as given in CAA Section 112.[1] The fractions are referred to as speciation profiles and are specific to unique emissions sources, which for airports, are subject to some degree of imprecision and uncertainty because of the lack of historical data.

Most of the USEPA information on HAP speciation profiles was obtained as a result of the FAA's effort to develop guidelines and regulations for major stationary and area sources; there is much less data relating to aircraft and airports. The disparity is due to the limited availability of historical data, the financial cost and technical difficulty in developing new data, and the potential that aircraft and airports are not significant sources of HAPs.[2]

[1] Refer to Section G.1.B.1.3 *Regulatory Background* in this appendix.
[2] FAA, *Select Resource Materials and Annotated Bibliography on the Topic of Hazardous Air Pollutants Associated with Aircraft, Airports, and Aviation*, July 1, 2003.

G.1.B.1.1.1 Aircraft[3]

The HAP emission inventory for aircraft engines was based on the results of the criteria and precursor pollutant emissions inventory[4] prepared using the FAA Emissions and Dispersion Modeling System (EDMS). Speciation profiles were applied to the total aircraft emissions of volatile organic compounds (VOC), total organic gases (TOG), and annual throughput of aviation gasoline (AvGas) to determine the annual emissions of HAPs caused by aircraft operations. However, the speciation profiles currently available were developed through aircraft-engine testing[5] conducted several years ago using older aircraft engines. The relatively recent improvements in jet engine design and technology that has reduced the products of incomplete combustion such as VOC and HC, are not reflected in the currently available speciation profiles. In addition, a limited number of engines and aircraft types were tested requiring the substitution of speciation profiles for similar aircraft when data is not specific. As a result, until engine testing for HAPs is conducted for newer aircraft engines, and for all aircraft types, the estimated level of HAPs is likely to be higher and less accurate than what actually would occur. Therefore, the HAP emission inventory for aircraft engines should be considered conservative and worst case.

G.1.B.1.1.2 Mobile Sources[6]

Speciation profiles for criteria pollutant emissions from the use of on-road vehicles, ground support equipment (GSE), and other non-road vehicles (mobile sources), does not consider the use of alternative fuel, such as biodiesel fuel and compressed natural gas (CNG), which would decrease the criteria pollutant emissions from these vehicles and subsequently reduce the level of HAP emissions. Therefore, the estimated level of HAP emissions from mobile sources should be considered conservative and reflective of the worst case.

G.1.B.1.2 Agency Coordination

The FAA invited the relevant Federal, State, and local air agencies to participate in three scoping meetings and a follow-up teleconference to ensure that the full range of issues relating to the HAP evaluation would be identified and discussed:

- April 5, 2005, FAA Airports District Office, Atlanta, Georgia
- May 3, 2005, Florida Department of Environmental Protection, West Palm Beach, Florida

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3 FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, Appendix I, *Hazardous Air Pollutant Discussion*, January 2005.

4 Criteria pollutants evaluated for an airport project are defined as carbon monoxide, nitrogen oxides, sulfur oxides, particulate matter (coarse particles of a diameter of 10 micrometers or less, PM_{10}, and fine particles of a diameter of 2.5 micrometers or less, $PM_{2.5}$), and includes hydrocarbons (volatile organic compounds, VOC; total hydrocarbons, THC; and nonmethane hydrocarbons, NMHC), a precursor pollutant of ozone development.

5 Including testing of turbine auxiliary power units (APUs).

6 FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, Appendix I, *Hazardous Air Pollutant Discussion*, January 2005.

- May 12, 2005, FAA Airports District Office, Atlanta Georgia
- September 21, 2005, teleconference

The following agencies and offices, which are specifically concerned with the evaluation of HAPs, were present during one or more of the scoping meetings and follow-up coordination teleconference:

- U.S. Environmental Protection Agency (USEPA) Region 4 Air Toxics Assessment and Implementation Section, Atlanta
- USEPA Region 4 Air Quality Modeling and Transportation Section, Atlanta
- USEPA Office of Transportation and Air Quality, Ann Arbor, Michigan
- FAA, Airports District Office, Orlando

As a result of the consultation and coordination efforts, a methodology and procedure for preparing the HAP emission evaluation were developed and an inventory of airport-related HAP emissions was prepared. The following sections provide a description of the Federal regulations pertaining to HAPs, a summary of the speciation profiles used to calculate HAP emissions, the methodology and procedure developed for calculating annual HAP emissions, and the DRAFT results of the HAP inventory for the FLL DEIS conditions at the time the environmental document was prepared (2005 Existing Conditions), and the future baseline and project alternatives for 2012 and 2020.

G.1.B.1.3 Regulatory Background

In 1970, Congress authorized the USEPA to regulate pollutants that were found to be more hazardous to human health than those regulated under the National Ambient Air Quality Standards (NAAQS). As a result, the CAA Amendments of 1970 included national HAP emissions standards (NESHAPs) for mercury, beryllium, and asbestos. During the ensuing 20 years, USEPA identified only seven pollutants as hazardous and allowed state agencies to develop their own regulations for what was referred to as “air toxics,” which all combined included up to 800 substances.

In the 1990 CAA Amendments, Congress renewed and intensified national efforts to reduce the emissions of HAPs. The 1990 Amendments list 189 hazardous air pollutants, including 172 individual compounds and 17 compound groups. These chemicals were not previously regulated under the NAAQS.

The establishment of the NESHAPs is found in Title I, Part A, Section 112 of the CAA, which lists source categories of HAP emissions. The list of source categories includes the aerospace industry but only as applied to aerospace manufacturing and rework facilities, particularly for painting and cleaning of large commercial aircraft during production and manufacturing.[7] The rule does not apply to minor painting or coating for touch-up operations where “minor coating imperfections are corrected following the main coating operation.”[8] Aircraft emissions and emissions from airport-related sources are not regulated under Section 112 of the CAA. The

[7] Federal Register, Volume 65 at pages 76941-76945 (65 FR 76941), 12/8/2000.
[8] USEPA, “Questions and Answers to Comments Relating to Aerospace Manufacturing,” October 1, 1998, available on the USEPA web site at www.epa.gov/ttn/atw/mactfnlalph.html.

principal source categories requiring Federal control of HAP emissions can be accessed from the Internet at www.epa.gov/ttn/atw/mactfnlalph.html.

G.1.B.1.4 Characteristics of HAPs

Hazardous air pollutants are gaseous organic and inorganic chemicals, compounds, and particulate matter that are either carcinogenic (known or suspected to cause cancer) or non-carcinogenic (known or suspected to cause other adverse health effects). These substances are believed to cause unique exposure risks because of the innate toxicity of each substance. The 189 substances listed in CAA Section 112 have a variety of toxic effects causing major health concerns relating to, among others, the nervous and reproductive systems, and lung and liver diseases.

The health effects from exposure to HAPs in the ambient air are influenced by the regional meteorology. Higher winds have a tendency to dilute the vaporized pollutants downwind but may also increase the volatilization rate of some liquids.[9] Greater wind speeds may also increase the concentration of nonvolatile contaminants sorbed[10] to soil and dust. Atmospheric instability, which relates to vertical motions in the air, may increase the dispersion of contaminants throughout various vertical levels whereas downwind contaminant concentrations are usually higher when stable atmospheric conditions exist. Precipitation reduces overall airborne contaminants by removing the particles from the air and volatile contaminants emit at lower rates from wet soil than from dry soil. In addition, solar radiation and temperature can also affect the volatilization of liquids. When considering the parameters that affect the formation and dispersion of HAPs, it is clear that health effects from HAP emissions is appropriately assessed on a regional level and not confined to a project-level analysis of a single source.

While the subject of human health effects from HAP emissions was raised during air quality scoping for the FLL DEIS, the FAA determined that the health effects to persons living in the vicinity of the airport could not be applied in a meaningful way when the HAP evaluation would be limited to a single source in a local area. As such, a human health risk assessment is not included in the HAP evaluation for the FLL DEIS air quality assessment.

G.1.B.2.0 METHODOLOGY

The HAP emission inventory was based on the results of the criteria and precursor pollutant emission inventory prepared to satisfy other regulatory requirements for the air quality assessment. As such, the sources of emissions that would be considered for the HAP evaluation would be the same sources considered for the regulatory evaluation of criteria and precursor pollutants. The HAPs evaluation would include emissions from the following sources:

[9] Keith, Lawrence H., et al., Handbook of Air Toxics – Sampling, Analysis, and Properties, 1995.

[10] Refers to the adsorption and/or absorption process. A substance that is attracted to a surface and remains concentrated on the surface is adsorbed, whereas absorption occurs when the substance is not only retained on the surface but also passes through the surface to become distributed throughout.

- Aircraft engines
- Ground support equipment (GSE)
- Auxiliary power units (APUs)
- Motor vehicles in parking lots/garages and on airport access roadways
- Stationary sources (emergency generators, surface coating (painting), and fuel/oil storage tanks)

G.1.B.2.1 Literature Review and Research

The FAA conducted a literature review and engaged in research to identify the relevant HAPs and appropriate speciation profiles that would be applicable to the unique emission sources at airports. Pursuant to discussions during air quality agency coordination meetings for the FLL DEIS, references obtained from the USEPA and the FAA were reviewed and relied upon as credible sources of speciation profiles and methodology for the FLL DEIS HAP evaluation.

G.1.B.2.1.1 USEPA Guidelines

The following USEPA guidelines and computer models were reviewed and used as sources of information and tools to prepare the HAP evaluation:

- USEPA *Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and Other Nonroad Components of the National Emissions Inventory (NEI), Volume I Methodology*, 2/10/2005 (hereafter referred to as the USEPA 2005 NEI).

  The National Emission Inventory (NEI) is a comprehensive inventory covering all criteria pollutants and HAPs for all areas of the United States. The NEI was created by the USEPA Monitoring and Analysis Division of the Emission Factor and Inventory Group, Research Triangle Park, North Carolina. The USEPA 2005 NEI was used for this HAP evaluation to provide speciation profiles for the use of nonroad engines, where data was provided for both gasoline- and diesel-powered nonroad engines. The USEPA 2005 NEI was the source of speciation profiles for gasoline- and diesel-powered GSE at FLL.

- USEPA *User's Guide to TANKS Storage Tank Emissions Calculation Software Version 4.0,* 9/30/1999, and TANKS software Version 4.0, obtained from USEPA Air CHIEF 12 Compact Disc, EPA 454/C-05-001, Version 12, June 2005.

  The TANKS computer program is designed to estimate air emissions from oil and fuel storage tanks. The TANKS program does not list specific emissions factors or speciation profiles for emissions from storage tanks. Rather, TANKS allows the user to enter specific information about a storage tank (dimensions, construction, etc.) the liquid contents (oil, fuel type, etc.) and the location of the tank (nearest city, ambient temperature, etc.). The program then generates an air emissions report listing the estimated emissions of pollutants, including HAPs, from the tanks. The TANKS program was used to estimate HAP emissions from the oil and fuel storage tanks at FLL.

- USEPA Office of Transportation and Air Quality, *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation*, EPA42/R-04-013, August 2004, and MOBILE software Version 6.2, available on the Internet from the USEPA Modeling and Inventories website at www.epa.gov/otaq/m6.htm.

  The MOBILE6 software program is designed to estimate emission rates for a highway motor vehicle fleet under a range of conditions. Version 6.2 of MOBILE has the capability to estimate particulate matter (PM) and mobile source HAP emissions. The MOBILE program was the source of speciation profiles for on-road mobile sources included in the FLL DEIS.

- USEPA Office of Air Quality Planning & Standards, *SPECIATE Version 3.2 Introduction and User's Guide, November 1, 2002*, *Repository of Total Organic Compound (TOC) and Particulate Matter (PM) Speciated Profiles*, and SPECIATE software Version 3.2, November 2002, available on the Internet from the USEPA Technology Transfer Network (TTN) Clearinghouse for Inventories & Emissions Factors website at www.epa.gov/ttn/chief/software/speciate.

  The SPECIATE program is a repository of total organic compound (TOC) and PM speciation profiles for various stationary sources. The SPECIATE program was the source of speciation profiles for HAP emissions from surface coating (painting).

G.1.B.2.1.2 FAA Guideline

The following FAA document was reviewed and used as a source of information to prepare the HAP evaluation:

- FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, Appendix I, *Hazardous Air Pollutant Discussion*, January 2005 (hereafter referred to as the ORD OMP EIS).

  As directed through agency coordination, the ORD OMP EIS document was referenced as a guide to the methodology and procedure for preparing the FLL DEIS HAP evaluation. The document provided speciation profiles for all aircraft, lead emissions from piston-engine aircraft, all profiles for APU operations, and all speciation profiles for emergency generators.

G.1.B.2.2 Airport-Related HAPs

The HAP evaluation for the FLL DEIS considers only airport-related sources,[11] which would not indicate emissions of all of the 189 substances identified in CAA Section 112. Rather, the evaluation for the FLL DEIS includes only those HAPs common at airports for which credible speciation profiles are available. The list given in **Table G.1.B-1**, ***HAPs Evaluated, by Source***, identifies the 19 substances (including one group of organic compounds) for which credible speciation profiles

[11] Airport-related sources include aircraft engines (including auxiliary power units, APUs), ground support equipment (GSE), motor vehicles on roadways and in parking lots, and stationary sources, such as emergency generators, surface coating, fuel and oil storage tanks.

could be identified and which were considered for analysis in this evaluation. A description of the most common airport-related HAPs is provided as **Attachment G.1.B-1**, ***HAP Characteristics***, to this appendix.

G.1.B.2.3 Speciation Profiles

Speciation profiles were obtained from the literature listed under the Paragraph G.1.B.2.1, *Literature Review and Research*. The set of speciation profiles used for the FLL DEIS HAP inventory is given in the following tables:

Table G.1.B-2 Aircraft Speciation Profiles

Table G.1.B-3 GSE Speciation Profiles

Table G.1.B-4 APU Speciation Profiles

Table G.1.B-5 Motor Vehicle Speciation Profiles

Table G.1.B-6 Emergency Generator Speciation Profiles

Table G.1.B-7 Surface Coating (Painting) Speciation Profiles

Table G.1.B-1
HAPS EVALUATED, BY SOURCE
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU
1,3-Butadiene	√	√	√		√
2,2,4-Trimethylpentane		√	√		
Acetaldehyde	√	√	√		√
Acrolein	√	√	√		√
Arsenic		√		√	
Benzene	√	√	√	√	√
Chromium VI		√	√	√	
Diesel Particulate Matter		√	√		
Ethylbenzene		√	√	√	
Formaldehyde	√	√	√	√	√
Hexane		√	√		
Lead	√			√	
Naphthalene	√	√		√	√
Nickel		√	√	√	
POM as 16-PAH			√		
Propionaldehyde			√		
Styrene		√	√		
Toluene	√	√	√	√	√
Xylene		√	√	√	

Notes: APUs are auxiliary power units.
GSE are ground support equipment.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

Source: Landrum & Brown analysis, 2007.

Table G.1.B-2
AIRCRAFT SPECIATION PROFILES

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION PROFILES BY AIRCRAFT ENGINE TYPE			
	PROFILES FOR TURBINE ENGINES[1]	SOURCE (tons per year)	PROFILES FOR PISTON ENGINES[2]	SOURCE (tons per year, unless otherwise noted)
1,3-Butadiene	0.018	VOC	0.0072	TOG
Acetaldehyde	0.004	VOC	0.0056	TOG
Acrolein	0.003	VOC	0.0013	TOG
Benzene	0.016	VOC	0.0376	TOG
Formaldehyde	0.096	VOC	0.0092	TOG
Lead[3]	--	--	0.56	g/gal[3] AvGas
Naphthalene	0.003	VOC	0.0012	TOG
Toluene	0.008	VOC	0.0737	TOG

Notes: VOCs are volatile organic compounds.
TOGs are total organic gases.
g/gal is grams of lead per gallon-use of low-lead aviation gasoline (AvGas).
"—" turbine engines do not use fuel that contains lead.

[1] Data obtained from FAA documentation: Table 2, *Speciation Profiles for Turbine Engine Aircraft*, given in Attachment I-4, *Hazardous Air Pollutant Speciation Profiles*, found at Appendix I, *Hazardous Air Pollutant Discussion* (reference Table I-15, *HAP Emissions – Existing Condition*), as provided in the FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, dated January 2005.

Speciation values were applied as a fraction to the emissions of volatile organic compounds (VOC) from turbine- and turbofan-powered aircraft. VOCs were estimated using the Emission and Dispersion Modeling System (EDMS) and were reported in the criteria and precursor emission inventory.

[2] Data obtained from FAA documentation: Table 4, *Total Organic Gases Speciation Profiles for Piston Aircraft*, found at Appendix I (see footnote "1" above).

Speciation values (except for lead) were applied as a fraction to the emissions of total organic gases (TOG) from piston-engine aircraft. TOGs were derived from VOC emissions estimated using the Emission and Dispersion Modeling System (EDMS) and reported in the criteria and precursor emission inventory. The USEPA factor of 1.25 was applied to VOC emissions to estimate TOG emissions, as provided in USEPA Memorandum dated June 8, 2005 (revised September 28, 2005) to Lee Beck, USEPA Office of Research and Development, *Development of VOC-to-TOG Conversion Factors* (see "Sources" below).

[3] Data obtained from FAA documentation: Section 2.1.2, *Piston Engines*, given in Attachment I-4, *Hazardous Air Pollutant Speciation Profiles*, found at Appendix I (see footnote "1" above). Inclusion of lead emissions was requested by USEPA Office of Transportation and Air Quality, Ann Arbor, MI.

Speciation value was applied to the total annual throughput of AvGas used for piston-engine aircraft, as directed in Section 2.1.2, *Piston Engines*, given in Attachment I-4, *Hazardous Air Pollutant Speciation Profiles*, found at Appendix I (see footnote "1" above).

Sources: FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, January 2005.
USEPA Memorandum to Lee Beck, USEPA Office of Research and Development, from Y. Hsu & D. Holoman, E.H. Pechan & Associates, Inc., *Development of VOC-to-TOG Conversion Factors* EPA Contract No. 68-D-00-265, WA No. 4-49, dated June 8, 2005 (revised September 28, 2005).
Landrum & Brown analysis, 2007.

Table G.1.B-3
GSE SPECIATION PROFILES

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION PROFILES BY ENGINE FUEL TYPE			
	GASOLINE ENGINES (4-STROKE)		DIESEL ENGINES	
	PROFILES	SOURCE (tons per year, unless otherwise noted)	PROFILES	SOURCE (tons per year, unless otherwise noted)
1,3-Butadiene[1]	0.0095212	VOC	0.0018616	VOC
2,2,4-Trimethylpentane[1]	0.019253927	VOC	0.000719235	VOC
Acetaldehyde[1]	0.0041006	VOC	0.05308	VOC
Acrolein[1]	0.0007	VOC	0.00303	VOC
Benzene[1]	0.052466	VOC	0.020344	VOC
Chromium VI[2]	0.00003604	g/gal fuel	0.0102	μg/Bhp-hr
Ethylbenzene[1]	0.019824	VOC	0.0031001	VOC
Formaldehyde[1]	0.01715	VOC	0.011815	VOC
Hexane[1]	0.0099219	VOC	0.0015913	VOC
Nickel[2]	0.000077486	g/gal fuel	2.035	μg/Bhp-hr
POM as 16-PAH[3]	0.10351	PM_{10}	0.001034792	PM_{10}
Propionaldehyde[1]	0.0018808	VOC	0.011815	VOC
Styrene[1]	0.00075849	VOC	0.00059448	VOC
Toluene[1]	0.071842	VOC	0.014967	VOC
Xylene[1]	0.067799	VOC	0.010582	VOC

Notes: GSE is ground support equipment.
VOCs are volatile organic compounds.
g/gal is grams of HAP emitted per gallon of fuel used.
μg/Bhp-hr is micrograms of HAP emitted per brake horsepower-hr of the equipment.
PM_{10} is particulate matter, 10 micrograms or less in diameter.

[1] Data obtained from USEPA documentation: Table D-1, *Speciation Profile for Specific Engines*, given in Appendix D, *Other Nonroad Mobile Sources Emission Estimating Methods and Data*, as provided in *Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and Other Nonroad Components of the National Emissions Inventory*, Volume I-Methodology, February 10, 2005.

[2] Data obtained from USEPA documentation: Table D-3, *Specific Metal Speciation Profile for Other Nonroad Equipment*, given in Appendix D (see footnote "1" above).

[3] Data obtained from USEPA documentation: Table D-2, *PAH Speciation Profile for Other Nonroad Equipment*, given in Appendix D (see footnote "1" above). POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

Sources: USEPA, *Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and Other Nonroad Components of the National Emissions Inventory* (NEI), Volume I Methodology, February 10, 2005.
Landrum & Brown analysis, 2007.

Table G.1.B-4
APU SPECIATION PROFILES

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION PROFILES[1] FOR APUs	
	PROFILES[1]	SOURCE (tons per year)
1,3-Butadiene	0.018	VOC
Acetaldehyde	0.004	VOC
Acrolein	0.003	VOC
Benzene	0.016	VOC
Formaldehyde	0.096	VOC
Naphthalene	0.003	VOC
Toluene	0.008	VOC

Notes: APUs are auxiliary power units.
VOCs are volatile organic compounds.

[1] Speciation profiles for APUs are the same as for turbine aircraft engines, given in Table G.1.B-2, *Aircraft Speciation Profiles*, assuming all APUs are turbine engines (piston-engine aircraft do not use APUs).

Sources: FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, January 2005.
Landrum & Brown analysis, 2007.

Table G.1.B-5
MOTOR VEHICLE SPECIATION PROFILES

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION PROFILES BY YEAR, BY ROADWAY TYPE, AND BY AVERAGE VEHICLE SPEED[1] (grams/VMT)				
	ARTERIAL ROADWAY				HIGHWAY RAMP
	2.5 MPH	10 MPH	15 MPH	30 MPH	35 MPH
	PROFILES FOR 2005 EXISTING CONDITIONS				
1,3-Butadiene	0.015839	0.007192	0.005745	0.004258	0.004827
2,2,4-Trimethylpentane	0.1916771	0.0536391	0.0459791	0.0326211	0.0360051
Acetaldehyde	0.015575	0.007961	0.006357	0.004380	0.004669
Acrolein	0.002315	0.001162	0.000908	0.000596	0.000621
Arsenic	0.00000723	0.00000723	0.00000723	0.00000723	0.00000723
Benzene	0.176333	0.062311	0.049722	0.037320	0.042436
Chromium VI	0.000001853	0.000001853	0.000001853	0.000001853	0.000001853
Ethylbenzene	0.08532952	0.02360030	0.02034030	0.01419130	0.01551230
Hexane	0.1717781	0.0305074	0.0288634	0.0182204	0.0183254
Formaldehyde	0.044513	0.022737	0.018075	0.012326	0.013068
Naphthalene	0.00336917	0.00112638	0.00105148	0.00094632	0.00092302
Nickel	0.000003516	0.000003516	0.000003516	0.000003516	0.000003516
Styrene	0.008798	0.003926	0.003139	0.002346	0.002687
Toluene	0.530960	0.153268	0.122678	0.092371	0.102078
Xylene	0.2933467	0.0857547	0.0728047	0.0516367	0.0874447
	PROFILES FOR 2012 ALTERNATIVES				
1,3-Butadiene	0.008229	0.003894	0.003129	0.002340	0.002528
2,2,4-Trimethylpentane	0.0949690	0.0288738	0.0233308	0.0178918	0.0189618
Acetaldehyde	0.008456	0.004513	0.003617	0.002483	0.002529
Acrolein	0.001126	0.000584	0.000465	0.000317	0.000322
Arsenic	0.000007294	0.000007294	0.000007294	0.000007294	0.000007294
Benzene	0.092971	0.034905	0.028083	0.021341	0.023031
Chromium VI	0.000001852	0.000001852	0.000001852	0.000001852	0.000001852
Ethylbenzene	0.0440503	0.0126475	0.0102145	0.0077867	0.0596355
Hexane	0.0861769	0.0167913	0.0136843	0.0104443	0.0103703
Formaldehyde	0.023356	0.012446	0.009951	0.006801	0.006911
Naphthalene	0.001767034	0.000664316	0.000628196	0.000178846	0.000578896
Nickel	0.000003515	0.000003515	0.000003515	0.000003515	0.000003515
Styrene	0.004498	0.002086	0.001673	0.001256	0.001367
Toluene	0.26451829	0.08177130	0.06596430	0.05034430	0.05341730
Xylene	0.1469917	0.0457572	0.0369002	0.0281342	0.0298702

Table G.1.B-5, *Continued*
MOTOR VEHICLE SPECIATION PROFILES

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION PROFILES BY YEAR, BY ROADWAY TYPE, AND BY AVERAGE VEHICLE SPEED[1] (grams/VMT)				
	ARTERIAL ROADWAY				HIGHWAY RAMP
	2.5 MPH	10 MPH	15 MPH	30 MPH	35 MPH
	PROFILES FOR 2020 ALTERNATIVES				
1,3-Butadiene	0.006029	0.002884	0.002324	0.001743	0.001842
2,2,4-Trimethylpentane	0.0639226	0.0201044	0.0161564	0.0122576	0.0128321
Acetaldehyde	0.006271	0.003388	0.002721	0.001867	0.001869
Acrolein	0.000824	0.000432	0.000346	0.000237	0.000237
Arsenic	0.000007370	0.000007370	0.000007370	0.000007370	0.000007370
Benzene	0.064342	0.024915	0.020043	0.015205	0.016133
Chromium VI	0.000001849	0.000001849	0.000001849	0.000001849	0.000001849
Ethylbenzene	0.0293032	0.0087310	0.0070045	0.0052718	0.0054837
Hexane	0.0546277	0.0107781	0.0086051	0.0063111	0.0062281
Formaldehyde	0.017342	0.009337	0.007484	0.005119	0.005116
Naphthalene	0.001205657	0.000517460	0.000491000	0.000462150	0.000435753
Nickel	0.000003514	0.000003514	0.000003514	0.000003514	0.000003514
Styrene	0.003255	0.001525	0.001227	0.000925	0.000985
Toluene	0.17830540	0.05694660	0.04571460	0.03456760	0.03620860
Xylene	0.0989705	0.0319230	0.0256270	0.0193720	0.0202980

Note: VMT is vehicle miles traveled.

[1] Data obtained from USEPA documentation: MOBILE 6.2.

Source: USEPA Office of Transportation and Air Quality, *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation*, EPA42/R-04-013, August 2004, and MOBILE software Version 6.2.

Table G.1.B-6
EMERGENCY GENERATOR SPECIATION PROFILES
STATIONARY SOURCE

TYPES OF HAZARDOUS AIR POLLUTANTS	SPECIATION RPOFILES[1] (lb/1,000 gal)
Arsenic	0.00132
Benzene	0.000214
Chromium VI	0.000248
Ethylbenzene	0.0000636
Formaldehyde	0.033
Lead	0.00151
Naphthalene	0.00113
Nickel	0.0845
POM as 16-PAH	0.00113
Toluene	0.0062
Xylene	0.000109

Notes: lb is pound of HAP.
gal is gallons of fuel.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

1 Data obtained from FAA documentation: Table 7, *Speciation Profiles for Fuel Oil Combustion Units*, given in Attachment I-4, *Hazardous Air Pollutant Speciation Profiles*, found at Appendix I, *Hazardous Air Pollutant Discussion*, as provided in the FAA, *Draft O'Hare International Airport Modernization Program Environmental Impact Statement*, dated January 2005.

Source: FAA, *Draft Chicago O'Hare International Airport Modernization Program Environmental Impact Statement*, Appendix I, *Hazardous Air Pollutant Discussion*, January 2005.

Table G.1.B-7
SURFACE COATING (PAINTING) SPECIATION PROFILE
STATIONARY SOURCE

TYPE OF HAZARDOUS AIR POLLUTANT	SPECIATION RPOFILE[1]	
	PROFILE[1]	SOURCE (tons per year)
Toluene	0.01248	THC

Note: THC is total hydrocarbons.

1 Data obtained from USEPA documentation: *SPECIATE Version 3.2.*

Source: USEPA, *SPECIATE Version 3.2 Introduction and User's Guide, November 1, 2002*, *Repository of Total Organic Compound (TOC) and Particulate Matter (PM) Speciated Profiles*, and SPECIATE software Version 3.2, November 2002.

G.1.B.3.0 PROCEDURES

The following sections provide details of the procedures followed to prepare EDMS emission input data and output files for application of the speciation profiles provided in Paragraph G.1.B.2.3. The calculations of HAP emissions were performed using the Microsoft Excel® spreadsheet program.

G.1.B.3.1 Aircraft

Speciation profiles for aircraft given in Table G.1.B-2 were applied to total aircraft emissions of TOGs, VOC, or applied to the total annual fuel throughput depending on the HAP and the engine type (i.e. piston vs. turbine). Although the aircraft fleet may change for a particular project alternative, the speciation profiles defined for each engine category would not change.

Before the speciation profiles could be applied, each aircraft/engine combination included in the EDMS study was identified as either a turbine-powered or piston-powered. The appropriate speciation profile for each HAP was applied to the corresponding source given in Table G.1.B-2, *Aircraft Speciation Profiles*.

G.1.B.3.2 Ground Support Equipment (GSE)

Speciation profiles for GSE given in Table G.1.B-3 were applied to the total emissions of PM_{10} or VOC, applied to the total annual fuel throughput, or applied according to the brake horsepower-hr (Bhp-hr), depending on the HAP. GSE assignments are determined according to the types of aircraft in the fleet. Consequently, although the aircraft fleet may change for a particular project year, thereby changing the number and type of GSE assigned for evaluation, the speciation profiles defined for GSE would not change.

Before the speciation profiles could be applied, the total emissions of VOC and PM_{10} due to the use of GSE were obtained from the EDMS output file. The total fuel use was categorized by type, gasoline or diesel fuel, and the Bhp-hr data was derived from the EDMS input file. The appropriate speciation profile for each HAP was applied to the corresponding source given in Table G.1.B-3, *GSE Speciation Profiles*.

G.1.B.3.3 APUs

Speciation profiles for turbine APUs given in Table G.1.B-4 were applied to the total APU emissions of VOCs. Although the aircraft fleet may change for a particular project year, the speciation profiles defined APUs would not change and are identical to the speciation profiles defined for turbine aircraft engines in Table G.1.B-2.

Before the speciation profiles could be applied, emissions from each APU were identified. The appropriate speciation profile for each HAP was applied to the corresponding source given in Table G.1.B-4, *APU Speciation Profiles*.

G.1.B.3.4 Motor Vehicles

Speciation profiles for motor vehicles given in Table G.1.B-5 were obtained by running the USEPA MOBILE vehicle emission factor program for each analysis year considered in the FLL DEIS, namely, 2005, 2012, and 2020. Speciation profiles were calculated for vehicles moving 35 miles per hour (MPH) on highway ramps, and 2.5 MPH (idle), 10 MPH, 15 MPH, and 30 MPH along arterial roadways. The emissions from motor vehicles would be expected to decrease with each consecutive year according to the USEPA mandate for lower vehicle emissions. Therefore, although the emissions would decrease under each later year, the profiles would remain constant.

Before the speciation profiles could be applied, the total number of vehicle miles traveled (VMT) in each speed category was determined using the EDMS input file. The appropriate speciation profile for vehicles in each speed category was applied to the VMT as directed in Table G.1.B-5, *Motor Vehicles Speciation Profiles*.

G.1.B.3.5 Stationary Sources

Emissions of HAPs were calculated for the types of stationary sources included in the air quality assessment of the FLL DEIS, namely, emergency generators, surface coating (painting), and fuel and oil storage tanks.

G.1.B.3.5.1 Emergency Generators

Speciation profiles for emergency generators given in Table G.1.B-6 were applied to the total annual fuel throughput (per 1,000 gallons of diesel fuel), depending on the HAP. The annual throughput of fuel for emergency generators would not be expected to change from year to year. Therefore, HAP emissions would remain constant throughout the FLL DEIS analysis years 2005, 2012, and 2020.

Before the speciation profiles could be applied, the total annual fuel throughput was derived from the EDMS input file. The appropriate speciation profile for each HAP was applied to the corresponding source given in Table G.1.B-6, *Emergency Generator Speciation Profiles*.

G.1.B.3.5.2 Surface Coating (Painting)

The speciation profiles for surface coating (painting) given in Table G.1.B-7 were obtained using the USEPA SPECIATE computer program. Solvent base paint was assumed for the paint type in SPECIATE. Before the speciation profiles could be applied, the total emissions of THCs were derived from EDMS input data. The appropriate speciation profiles were applied to the corresponding source given in Table G.1.B-7, *Surface Coating (Painting) Speciation Profiles*. The increase in HAP emissions from painting was estimated to increase each successive year proportionally with the increase in annual aircraft operations.

G.1.B.3.5.3 Fuel and Oil Storage Tanks

The emissions of HAPs from fuel and oil storage tanks were determined using the USEPA TANKS program. For each tank, the physical characteristics were input into the model, such as, horizontal tank or underground tank, whether or not the tank

had a floating roof, and the dimensions of the tanks. There were no speciation profiles applied outside the TANKS program for fuel and oil storage tanks as the program output provides total annual emissions for each tank. The increase in HAP emissions from fuel and oil storage tanks was estimated to increase each successive year proportionally with the increase in annual fuel throughput.

G.1.B.4.0 RESULTS

The results of the HAP emission inventory for the 2005 Existing Conditions and all the future baseline and project alternatives are given in the following tables:

Table G.1.B-8 2005 Existing Conditions

Table G.1.B-9 2012 Alternative A – No Action

Table G.1.B-10 2012 Alternative B1

Table G.1.B-11 2012 Alternative B1b

Table G.1.B-12 2012 Alternative B1c

Table G.1.B-13 2012 Alternative B4

Table G.1.B-14 2012 Alternative B5

Table G.1.B-15 2012 Alternative C1

Table G.1.B-16 2020 Alternative A – No Action

Table G.1.B-17 2020 Alternative B1

Table G.1.B-18 2020 Alternative B1b

Table G.1.B-19 2020 Alternative B1c

Table G.1.B-20 2020 Alternative B4

Table G.1.B-21 2020 Alternative B5

Table G.1.B-22 2020 Alternative C1

Table G.1.B-23 2020 Alternative D1

Table G.1.B-24 2020 Alternative D2

Table G.1.B-8
HAP EMISSION INVENTORY – 2005 EXISTING CONDITIONS
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	8.09	1.54	1.02	-	0.07	**10.72**
2,2,4-Trimethylpentane	-	9.70	1.43	-	-	**11.13**
Acetaldehyde	18.17	6.69	4.16	-	0.10	**29.13**
Acrolein	8.66	1.77	0.28	-	0.08	**10.78**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	8.70	0.00	6.33	0.03	0.65	**15.72**
Chromium VI	-	0.00	0.00	0.00	-	**0.00**
Diesel Particulate Matter[1]	-	4.80	8.70	-	-	**13.50**
Ethylbenzene	-	0.11	2.07	0.03	-	**2.21**
Formaldehyde	66.64	2.70	10.02	0.37	0.69	**80.41**
Hexane	-	2.62	1.04	-	-	**3.65**
Lead	0.53	-	-	0.00	-	**0.53**
Naphthalene	0.20	0.17	-	0.00	0.03	**0.40**
Nickel	-	0.00	0.00	0.00	-	**0.00**
POM° as 16-PAH	-	-	0.56	-	-	**0.56**
Propionaldehyde	-	-	1.01	-	-	**1.01**
Styrene	-	2.94	0.11	-	-	**3.05**
Toluene	3.80	1.09	7.76	1.78	0.24	**14.67**
Xylene	-	17.36	7.07	0.17	-	**24.61**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-9
HAP EMISSION INVENTORY – 2012 Alternative A – No Action
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	14.76	2.81	1.87	-	0.12	**19.56**
2,2,4-Trimethylpentane	-	17.71	2.61	-	-	**20.31**
Acetaldehyde	33.17	12.22	7.60	-	0.18	**53.16**
Acrolein	15.80	3.22	0.52	-	0.14	**19.68**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	15.88	0.00	11.56	0.06	1.19	**28.69**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	18.10	33.30	-	-	**51.40**
Ethylbenzene	-	0.20	3.78	0.06	-	**4.04**
Formaldehyde	121.62	4.93	18.28	0.68	1.25	**146.77**
Hexane	-	4.77	1.89	-	-	**6.67**
Lead	0.97	-	-	0.00	-	**0.98**
Naphthalene	0.36	0.32	-	0.00	0.06	**0.74**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	1.01	-	-	**1.01**
Propionaldehyde	-	-	1.85	-	-	**1.85**
Styrene	-	5.37	0.20	-	-	**5.57**
Toluene	6.94	1.99	14.17	3.24	0.44	**26.78**
Xylene	-	31.69	12.91	0.32	-	**44.92**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-10
HAP EMISSION INVENTORY – 2012 Alternative B1
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	9.94	1.89	1.26	-	0.08	**13.17**
2,2,4-Trimethylpentane	-	11.92	1.75	-	-	**13.67**
Acetaldehyde	22.33	8.22	5.12	-	0.12	**35.79**
Acrolein	10.63	2.17	0.35	-	0.09	**13.25**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	10.69	0.00	7.78	0.04	0.80	**19.31**
Chromium VI	-	0.00	0.00	0.00	-	**0.00**
Diesel Particulate Matter[1]	-	19.00	34.90	-	-	**53.90**
Ethylbenzene	-	0.13	2.54	0.04	-	**2.72**
Formaldehyde	81.87	3.32	12.31	0.46	0.84	**98.80**
Hexane	-	3.21	1.27	-	-	**4.49**
Lead	0.66	-	-	0.00	-	**0.66**
Naphthalene	0.24	0.21	-	0.00	0.04	**0.50**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.68	-	-	**0.68**
Propionaldehyde	-	-	1.25	-	-	**1.25**
Styrene	-	3.62	0.13	-	-	**3.75**
Toluene	4.67	1.34	9.54	2.18	0.29	**18.03**
Xylene	-	21.33	8.69	0.21	-	**30.24**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-11
HAP EMISSION INVENTORY – 2012 Alternative B1b
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	9.62	1.83	1.22	-	0.08	**12.75**
2,2,4-Trimethylpentane	-	11.54	1.70	-	-	**13.24**
Acetaldehyde	21.62	7.96	4.95	-	0.12	**34.65**
Acrolein	10.30	2.10	0.34	-	0.09	**12.83**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	10.35	0.00	7.53	0.04	0.78	**18.70**
Chromium VI	-	0.00	0.00	0.00	-	**0.00**
Diesel Particulate Matter[1]	-	19.10	34.90	-	-	**54.00**
Ethylbenzene	-	0.13	2.46	0.04	-	**2.63**
Formaldehyde	79.27	3.22	11.92	0.44	0.82	**95.67**
Hexane	-	3.11	1.23	-	-	**4.34**
Lead	0.64	-	-	0.00	-	**0.64**
Naphthalene	0.23	0.21	-	0.00	0.04	**0.48**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.66	-	-	**0.66**
Propionaldehyde	-	-	1.21	-	-	**1.21**
Styrene	-	3.50	0.13	-	-	**3.63**
Toluene	4.53	1.30	9.23	2.11	0.29	**17.46**
Xylene	-	20.66	8.42	0.21	-	**29.28**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-12
HAP EMISSION INVENTORY – 2012 Alternative B1c
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	11.49	2.18	1.46	-	0.09	**15.23**
2,2,4-Trimethylpentane	-	13.79	2.03	-	-	**15.82**
Acetaldehyde	25.82	9.51	5.92	-	0.14	**41.39**
Acrolein	12.30	2.51	0.40	-	0.11	**15.32**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	12.36	0.00	9.00	0.05	0.93	**22.34**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	17.20	33.10	-	-	**50.30**
Ethylbenzene	-	0.15	2.94	0.05	-	**3.14**
Formaldehyde	94.69	3.84	14.24	0.53	0.98	**114.27**
Hexane	-	3.72	1.47	-	-	**5.19**
Lead	0.76	-	-	0.00	-	**0.76**
Naphthalene	0.28	0.25	-	0.00	0.05	**0.57**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.79	-	-	**0.79**
Propionaldehyde	-	-	1.44	-	-	**1.44**
Styrene	-	4.18	0.15	-	-	**4.34**
Toluene	5.41	1.55	11.03	2.52	0.34	**20.85**
Xylene	-	24.68	10.05	0.25	-	**34.98**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-13
HAP EMISSION INVENTORY – 2012 Alternative B4
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	8.91	1.69	1.13	-	0.07	**11.80**
2,2,4-Trimethylpentane	-	10.69	1.57	-	-	**12.26**
Acetaldehyde	20.01	7.37	4.59	-	0.11	**32.08**
Acrolein	9.53	1.95	0.31	-	0.08	**11.87**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	9.58	0.00	6.98	0.04	0.72	**17.31**
Chromium VI	-	0.00	0.00	0.00	-	**0.00**
Diesel Particulate Matter[1]	-	18.70	34.30	-	-	**53.00**
Ethylbenzene	-	0.12	2.28	0.04	-	**2.44**
Formaldehyde	73.40	2.98	11.03	0.41	0.76	**88.57**
Hexane	-	2.88	1.14	-	-	**4.02**
Lead	0.59	-	-	0.00	-	**0.59**
Naphthalene	0.22	0.19	-	0.00	0.04	**0.44**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.61	-	-	**0.61**
Propionaldehyde	-	-	1.12	-	-	**1.12**
Styrene	-	3.24	0.12	-	-	**3.36**
Toluene	4.19	1.20	8.55	1.96	0.26	**16.16**
Xylene	-	19.13	7.79	0.19	-	**27.11**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-14
HAP EMISSION INVENTORY – 2012 Alternative B5
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	9.85	1.87	1.25	-	0.08	**13.05**
2,2,4-Trimethylpentane	-	11.82	1.74	-	-	**13.56**
Acetaldehyde	22.14	8.15	5.07	-	0.12	**35.48**
Acrolein	10.54	2.15	0.35	-	0.09	**13.13**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	10.60	0.00	7.72	0.04	0.80	**19.15**
Chromium VI	-	0.00	0.00	0.00	-	**0.00**
Diesel Particulate Matter[1]	-	19.00	34.90	-	-	**53.90**
Ethylbenzene	-	0.13	2.52	0.04	-	**2.70**
Formaldehyde	81.18	3.29	12.20	0.45	0.84	**97.96**
Hexane	-	3.19	1.26	-	-	**4.45**
Lead	0.65	-	-	0.00	-	**0.65**
Naphthalene	0.24	0.21	-	0.00	0.04	**0.49**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.68	-	-	**0.68**
Propionaldehyde	-	-	1.24	-	-	**1.24**
Styrene	-	3.59	0.13	-	-	**3.72**
Toluene	4.63	1.33	9.46	2.16	0.29	**17.87**
Xylene	-	21.15	8.62	0.21	-	**29.99**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-15
HAP EMISSION INVENTORY – 2012 Alternative C1
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	13.62	2.59	1.73	-	0.11	**18.05**
2,2,4-Trimethylpentane	-	16.34	2.41	-	-	**18.75**
Acetaldehyde	30.61	11.27	7.01	-	0.17	**49.06**
Acrolein	14.58	2.97	0.48	-	0.13	**18.16**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	14.65	0.00	10.67	0.06	1.10	**26.48**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	18.70	34.40	-	-	**53.10**
Ethylbenzene	-	0.18	3.49	0.06	-	**3.73**
Formaldehyde	112.24	4.55	16.87	0.62	1.16	**135.45**
Hexane	-	4.41	1.74	-	-	**6.15**
Lead	0.90	-	-	0.00	-	**0.90**
Naphthalene	0.33	0.29	-	0.00	0.06	**0.68**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.94	-	-	**0.94**
Propionaldehyde	-	-	1.71	-	-	**1.71**
Styrene	-	4.96	0.18	-	-	**5.14**
Toluene	6.41	1.84	13.07	2.99	0.40	**24.71**
Xylene	-	29.25	11.92	0.29	-	**41.46**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-16
HAP EMISSION INVENTORY – 2020 Alternative A – No Action
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	25.51	4.85	3.23	-	0.21	**33.79**
2,2,4-Trimethylpentane	-	30.59	4.50	-	-	**35.10**
Acetaldehyde	57.30	21.11	13.13	-	0.31	**91.85**
Acrolein	27.29	5.57	0.89	-	0.24	**34.00**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	27.43	0.00	19.97	0.10	2.06	**49.57**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	21.10	38.80	-	-	**59.90**
Ethylbenzene	-	0.34	6.53	0.10	-	**6.98**
Formaldehyde	210.13	8.52	31.59	1.17	2.17	**253.57**
Hexane	-	8.25	3.27	-	-	**11.52**
Lead	1.68	-	-	0.00	-	**1.68**
Naphthalene	0.62	0.55	-	0.00	0.10	**1.27**
Nickel	-	0.00	0.00	0.01	-	**0.02**
POM° as 16-PAH	-	-	1.75	-	-	**1.75**
Propionaldehyde	-	-	3.20	-	-	**3.20**
Styrene	-	9.28	0.34	-	-	**9.62**
Toluene	12.00	3.44	24.47	5.60	0.76	**46.27**
Xylene	-	54.76	22.31	0.55	-	**77.62**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-17
HAP EMISSION INVENTORY – 2020 Alternative B1
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	11.25	2.14	1.43	-	0.09	**14.91**
2,2,4-Trimethylpentane	-	13.50	1.99	-	-	**15.49**
Acetaldehyde	25.28	9.31	5.79	-	0.14	**40.53**
Acrolein	12.04	2.46	0.39	-	0.11	**15.00**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	12.10	0.00	8.81	0.05	0.91	**21.87**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	22.10	40.70	-	-	**62.80**
Ethylbenzene	-	0.15	2.88	0.05	-	**3.08**
Formaldehyde	92.72	3.76	13.94	0.52	0.96	**111.89**
Hexane	-	3.64	1.44	-	-	**5.08**
Lead	0.74	-	-	0.00	-	**0.74**
Naphthalene	0.27	0.24	-	0.00	0.05	**0.56**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.77	-	-	**0.77**
Propionaldehyde	-	-	1.41	-	-	**1.41**
Styrene	-	4.10	0.15	-	-	**4.25**
Toluene	5.29	1.52	10.80	2.47	0.33	**20.42**
Xylene	-	24.16	9.84	0.24	-	**34.25**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-18
HAP EMISSION INVENTORY – 2020 Alternative B1b
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	10.94	2.08	1.39	-	0.09	**14.49**
2,2,4-Trimethylpentane	-	13.12	1.93	-	-	**15.05**
Acetaldehyde	24.58	9.05	5.63	-	0.13	**39.39**
Acrolein	11.71	2.39	0.38	-	0.10	**14.58**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	11.76	0.00	8.57	0.04	0.88	**21.26**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	22.30	40.80	-	-	**63.10**
Ethylbenzene	-	0.15	2.80	0.04	-	**2.99**
Formaldehyde	90.12	3.66	13.55	0.50	0.93	**108.76**
Hexane	-	3.54	1.40	-	-	**4.94**
Lead	0.72	-	-	0.00	-	**0.72**
Naphthalene	0.27	0.24	-	0.00	0.04	**0.55**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.75	-	-	**0.75**
Propionaldehyde	-	-	1.37	-	-	**1.37**
Styrene	-	3.98	0.15	-	-	**4.13**
Toluene	5.15	1.47	10.50	2.40	0.32	**19.84**
Xylene	-	23.49	9.57	0.24	-	**33.29**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-19
HAP EMISSION INVENTORY – 2020 Alternative B1c
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	10.94	2.08	1.39	-	0.09	**14.49**
2,2,4-Trimethylpentane	-	13.12	1.93	-	-	**15.05**
Acetaldehyde	24.58	9.05	5.63	-	0.13	**39.39**
Acrolein	11.71	2.39	0.38	-	0.10	**14.58**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	11.76	0.00	8.57	0.04	0.88	**21.26**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	18.60	35.80	-	-	**54.40**
Ethylbenzene	-	0.15	2.80	0.04	-	**2.99**
Formaldehyde	90.12	3.66	13.55	0.50	0.93	**108.76**
Hexane	-	3.54	1.40	-	-	**4.94**
Lead	0.72	-	-	0.00	-	**0.72**
Naphthalene	0.27	0.24	-	0.00	0.04	**0.55**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.75	-	-	**0.75**
Propionaldehyde	-	-	1.37	-	-	**1.37**
Styrene	-	3.98	0.15	-	-	**4.13**
Toluene	5.15	1.47	10.50	2.40	0.32	**19.84**
Xylene	-	23.49	9.57	0.24	-	**33.29**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-20
HAP EMISSION INVENTORY – 2020 Alternative B4
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	10.64	2.02	1.35	-	0.09	**14.10**
2,2,4-Trimethylpentane	-	12.76	1.88	-	-	**14.64**
Acetaldehyde	23.91	8.81	5.48	-	0.13	**38.32**
Acrolein	11.39	2.32	0.37	-	0.10	**14.18**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	11.44	0.00	8.33	0.04	0.86	**20.68**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	21.50	39.40	-	-	**60.90**
Ethylbenzene	-	0.14	2.72	0.04	-	**2.91**
Formaldehyde	87.67	3.56	13.18	0.49	0.90	**105.80**
Hexane	-	3.44	1.36	-	-	**4.80**
Lead	0.70	-	-	0.00	-	**0.70**
Naphthalene	0.26	0.23	-	0.00	0.04	**0.53**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.73	-	-	**0.73**
Propionaldehyde	-	-	1.33	-	-	**1.33**
Styrene	-	3.87	0.14	-	-	**4.02**
Toluene	5.01	1.43	10.21	2.34	0.32	**19.30**
Xylene	-	22.85	9.31	0.23	-	**32.38**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-21
HAP EMISSION INVENTORY – 2020 Alternative B5
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	11.17	2.12	1.42	-	0.09	**14.80**
2,2,4-Trimethylpentane	-	13.40	1.97	-	-	**15.37**
Acetaldehyde	25.10	9.24	5.75	-	0.14	**40.23**
Acrolein	11.95	2.44	0.39	-	0.11	**14.89**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	12.01	0.00	8.75	0.05	0.90	**21.71**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	22.10	40.70	-	-	**62.80**
Ethylbenzene	-	0.15	2.86	0.05	-	**3.06**
Formaldehyde	92.03	3.73	13.83	0.51	0.95	**111.06**
Hexane	-	3.61	1.43	-	-	**5.04**
Lead	0.74	-	-	0.00	-	**0.74**
Naphthalene	0.27	0.24	-	0.00	0.05	**0.56**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.77	-	-	**0.77**
Propionaldehyde	-	-	1.40	-	-	**1.40**
Styrene	-	4.06	0.15	-	-	**4.22**
Toluene	5.25	1.51	10.72	2.45	0.33	**20.26**
Xylene	-	23.98	9.77	0.24	-	**33.99**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-22
HAP EMISSION INVENTORY – 2020 Alternative C1
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	15.77	3.00	2.00	-	0.13	**20.90**
2,2,4-Trimethylpentane	-	18.92	2.78	-	-	**21.70**
Acetaldehyde	35.43	13.05	8.12	-	0.19	**56.80**
Acrolein	16.88	3.44	0.55	-	0.15	**21.02**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	16.96	0.00	12.35	0.06	1.28	**30.65**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	21.60	39.80	-	-	**61.40**
Ethylbenzene	-	0.21	4.04	0.06	-	**4.32**
Formaldehyde	129.94	5.27	19.53	0.72	1.34	**156.81**
Hexane	-	5.10	2.02	-	-	**7.12**
Lead	1.04	-	-	0.00	-	**1.04**
Naphthalene	0.38	0.34	-	0.00	0.06	**0.79**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	1.08	-	-	**1.08**
Propionaldehyde	-	-	1.98	-	-	**1.98**
Styrene	-	5.74	0.21	-	-	**5.95**
Toluene	7.42	2.13	15.13	3.46	0.47	**28.61**
Xylene	-	33.86	13.80	0.34	-	**48.00**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-23
HAP EMISSION INVENTORY – 2020 Alternative D1
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	14.57	2.77	1.85	-	0.12	**19.30**
2,2,4-Trimethylpentane	-	17.47	2.57	-	-	**20.05**
Acetaldehyde	32.73	12.06	7.50	-	0.18	**52.46**
Acrolein	15.59	3.18	0.51	-	0.14	**19.42**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	15.67	0.00	11.41	0.06	1.18	**28.31**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	21.80	40.10	-	-	**61.90**
Ethylbenzene	-	0.20	3.73	0.06	-	**3.99**
Formaldehyde	120.03	4.87	18.04	0.67	1.24	**144.85**
Hexane	-	4.71	1.87	-	-	**6.58**
Lead	0.96	-	-	0.00	-	**0.96**
Naphthalene	0.35	0.31	-	0.00	0.06	**0.73**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	1.00	-	-	**1.00**
Propionaldehyde	-	-	1.83	-	-	**1.83**
Styrene	-	5.30	0.20	-	-	**5.50**
Toluene	6.85	1.96	13.98	3.20	0.43	**26.43**
Xylene	-	31.28	12.74	0.31	-	**44.34**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

Table G.1.B-24
HAP EMISSION INVENTORY – 2020 Alternative D2
Fort Lauderdale-Hollywood International Airport

TYPES OF HAZARDOUS AIR POLLUTANTS	ANNUAL HAP EMISSIONS BY SOURCE (tons per year)					
	AIRCRAFT	MOTOR VEHICLES	GSE	STATIONARY SOURCES	APU	TOTAL
1,3-Butadiene	13.37	2.54	1.69	-	0.11	**17.71**
2,2,4-Trimethylpentane	-	16.04	2.36	-	-	**18.40**
Acetaldehyde	30.04	11.06	6.88	-	0.16	**48.15**
Acrolein	14.31	2.92	0.47	-	0.13	**17.82**
Arsenic	-	0.00	-	0.00	-	**0.00**
Benzene	14.38	0.00	10.47	0.05	1.08	**25.98**
Chromium VI	-	0.01	0.00	0.00	-	**0.01**
Diesel Particulate Matter[1]	-	21.40	39.40	-	-	**60.80**
Ethylbenzene	-	0.18	3.42	0.05	-	**3.66**
Formaldehyde	110.15	4.47	16.56	0.61	1.14	**132.93**
Hexane	-	4.32	1.71	-	-	**6.04**
Lead	0.88	-	-	0.00	-	**0.88**
Naphthalene	0.32	0.29	-	0.00	0.05	**0.67**
Nickel	-	0.00	0.00	0.01	-	**0.01**
POM° as 16-PAH	-	-	0.92	-	-	**0.92**
Propionaldehyde	-	-	1.68	-	-	**1.68**
Styrene	-	4.87	0.18	-	-	**5.05**
Toluene	6.29	1.80	12.83	2.94	0.40	**24.25**
Xylene	-	28.70	11.69	0.29	-	**40.69**

Notes: HAP is hazardous air pollutants.
Values equal to 0.00 are less than .005 tons per year.
"-" speciation profiles were not available for these pollutants.
GSE is ground support equipment.
APUs are auxiliary power units.
POM is polycyclic organic matter; PAH is polycyclic aromatic hydrocarbons (a set of 16 HAPs)

[1] Data obtained from particulate matter emissions estimated using the Emissions and Dispersion Modeling System (EDMS), which were reported in the criteria and precursor emission inventory.

Source: Landrum & Brown analysis, 2007.

G.1.B.5.0 REMARKS

An evaluation of HAP emissions due to airport projects is not required under NEPA or by the provisions of the CAA. The HAP evaluation was prepared using the best available information and was based on accepted USEPA methodology and procedures as determined appropriate through coordination with the relevant Federal, state, and local air agencies. The HAP inventory is provided for disclosure purposes only and should not be relied on as an interpretation of health risks, the evaluation should not be compared to other sources of HAPs in the region, or compared to HAP emissions reported for other airports.

ATTACHMENT G.1.B-1
HAP Characteristics

The descriptions and characteristics of several of the airport-related HAPS were obtained from the Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/toxfaq.html, the Toxicology Data Network http://sis.nlm.nih.gov/chemical.html, and the USEPA Air Toxics Website. http://www.epa.gov/ttn/atw/.

Butadiene

1,3-butadiene is a colorless gas with a mild, aromatic, gasoline-like odor. It is non-corrosive but highly flammable. This pollutant is a byproduct of petroleum processing and is used in the production of synthetic rubber and plastics. Small amounts of 1,3-butadiene are found in gasoline, automobile exhaust, cigarette smoke, and wood-fire smoke. The majority of 1,3-butadiene is released into the air and humans are typically exposed to the pollutant via inhalation. Breathing very high levels of 1,3-butadiene for a short time may cause central nervous system damage, blurred vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. Breathing lower levels of this pollutant may cause irritation of the eyes, nose, and throat. The U.S. Department of Health and Human Services (DHHS) has determined that 1,3-butadiene can reasonably be considered to be a human carcinogen.

Acetaldehyde

Acetaldehyde is mainly used as an intermediate in the synthesis of other chemicals. It is ubiquitous in the environment and may be formed in the body from the breakdown of ethanol. Acute (short-term) exposure to acetaldehyde results in irritation of the eyes, skin, and respiratory tract. Symptoms of chronic (long-term) intoxication of acetaldehyde resemble those of alcoholism. Acetaldehyde is considered a probable human carcinogen based on inadequate human cancer studies and animal studies that have shown nasal tumors in rats and laryngeal tumors in hamsters.

Acrolein

Acrolein is a clear or yellow liquid with a disagreeable odor. It dissolves in water very easily and quickly changes to a vapor when heated. It also burns easily. Small amounts of acrolein can be formed and can enter the air when trees, tobacco, other plants, gasoline, and oil are burned. Acrolein is used as a pesticide to control algae, weeds, bacteria, and mollusks. It is also used to make other chemicals. Acrolein is severely irritating to skin, eyes, and mucous membranes. Inhalation of acrolein may result in respiratory distress and delayed pulmonary edema.

The DHHS has determined that acrolein may possibly be a human carcinogen. The International Agency for Research on Cancer (IARC) has determined that acrolein is not classifiable as to its carcinogenicity to humans.

Benzene

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. The DHHS has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Formaldehyde

At room temperature, formaldehyde is a colorless, flammable gas that has a distinct, pungent smell. It is also known as methanal, methylene oxide, oxymethyline, methylaldehyde, and oxomethane. Formaldehyde is naturally produced in small amounts in our bodies. It is used in the production of fertilizer, paper, plywood, and urea-formaldehyde resins. It is also used as a preservative in some foods and in many products used around the house, such as antiseptics, medicines, and cosmetics. Smog is a major source of formaldehyde exposure. Low levels of formaldehyde can cause irritation of the eyes, nose, throat, and skin. It is possible that people with asthma may be more sensitive to the effects of inhaled formaldehyde. The DHHS has determined that formaldehyde may reasonably be considered to be a carcinogen.

Lead

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain. There is inadequate evidence to clearly determine lead's carcinogenicity in humans.

Napthalene

Naphthalene is a white solid that evaporates easily, and is found naturally in fuels when they are burned. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. The USEPA determined that naphthalene is not classifiable as to human carcinogenicity.

Propionaldehyde

Propionaldehyde is used in the manufacture of plastics, in the synthesis of rubber chemicals, and as a disinfectant and preservative. Limited information is available on the health effects of propionaldehyde. No information is available on the acute (short-term), chronic (long-term), reproductive, developmental or carcinogenic effects of propionaldehyde in humans. Animal studies have reported that exposure to high levels of propionaldehyde, via inhalation, results in anesthesia and liver damage, and intraperitoneal exposure results in increased blood pressure. USEPA has not classified propionaldehyde for carcinogenicity.

Toluene

Toluene is added to gasoline, used to produce benzene, and used as a solvent. Exposure to toluene may occur from breathing ambient or indoor air. The central nervous system (CNS) is the primary target organ for toluene toxicity in both humans and animals for acute (short-term) and chronic (long-term) exposures. CNS dysfunction and narcosis have been frequently observed in humans acutely exposed to toluene by inhalation; symptoms include fatigue, sleepiness, headaches, and nausea. Chronic inhalation exposure of humans to toluene also causes irritation of the upper respiratory tract and eyes, sore throat, dizziness, and headache. Human studies have reported developmental effects, such as CNS dysfunction, attention deficits, and minor craniofacial and limb anomalies, in the children of pregnant women exposed to toluene or mixed solvents by inhalation during pregnancy. However, these studies are not conclusive due to many confounding variables. USEPA has classified toluene as not classifiable as to human carcinogenicity.

Xylene

Xylene is released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents. Acute (short-term) inhalation exposure to mixed Xylene in humans results in irritation of the eyes, nose, and throat, gastrointestinal effects, eye irritation, and neurological effects. Chronic (long-term) inhalation exposure of humans to mixed

Xylene results primarily in central nervous system (CNS) effects, such as headache, dizziness, fatigue, and tremors; respiratory, cardiovascular, and kidney effects have also been reported. USEPA has not classified mixed Xylene as a human carcinogen.